Generic Advertising in Concentrated and Differentiated Agricultural Markets

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Abstract

This study develops an analytical framework to examine the impact of generic advertising on brand advertising with alternative assumptions on demand changes (shift-up and rotation), product differentiation, market concentration, and relationship between commodity and brand advertising programs. The newly developed model allows one to determine the relationship between generic and brand advertising, which has not been clearly shown in previous studies. Analytical results show that when generic advertising leads to an inelastic demand, generic advertising would help brand advertising and could decrease the optimal brand advertising expenditures. However, when generic advertising leads to an elastic demand, it would negatively affect the profitability of brand advertising

Keyword: check off, generic advertising**,** brand advertising, vertical product differentiation**.**

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As agricultural producers are increasingly integrated and become larger, these large production units tend to produce differentiated and identity-preserved products that focus on certain product attributes and consumer demands. Currently, almost $1billion is spent annually to promote agricultural commodities and major commodity groups (e.g., dairy, beef, and pork) invest majority shares of their checkoff budgets in generic advertising. Many studies in the agricultural economics literature indicate that the generic advertising has successfully increased the industry demand for most commodity groups. One of important assumptions of generic advertising is that each industry produces a homogeneous product. Therefore the purpose of generic advertising is to increase the industry demand while expecting equal benefit to each producer. However, in recent years, as agricultural and food industries are more concentrated and vertically integrated, products of these industries become more differentiated, which leads to various agricultural product brands and separate brand advertising programs. Brand advertising intends to increase market share of its own brand by persuading consumers to prefer its own brand to other brands. Through various brand advertising programs, producers try to differentiate their products emphasizing their unique quality attributes. Obviously, this is not consistent with the objective of generic advertising. Therefore, opponents of generic advertising claim that since generic advertising sends a signal that all products are homogeneous, it weakens brand messages by producers of differentiated products. These arguments are extremely important for many commodity checkoff programs and could be a direct challenge to the future of these programs.

The purpose of this study is to investigate the effectiveness of generic advertising and the relationship between commodity and brand advertising under the differentiated product environments. We develop an analytical model that considers product differentiation, market concentration, and relationship between commodity and brand advertising programs. Then the analysis is devoted to examine welfare distribution of generic advertising among producers who produce different quality level of products. Analytical results are expected to vary by types of demand shifts, market concentration, degree of product differentiation, and product relationship (i.e., substitutes, complements, and independent).

Review of Previous Studies

There have been several studies investigating the relationship between generic and brand advertising under product differentiation. The papers mostly focus on theoretical development of the effectiveness of advertising programs at firm and industry levels. Crespi and Marette (2002) investigate the effects of generic advertising on the product differentiation among competing brands. Crespi and Marette's framework follows Mussa and Rosen (1978) to develop an analytical model under the assumption of vertical product differentiation. The analytical derivation examines how the effectiveness and the optimal level of brand advertising are affected by generic advertising when market demands are derived from consumer utilities with differentiated product qualities. Results of the study show that generic advertising may benefit the low quality producers more than the high quality producers. The findings bring an important implication to

agricultural and food industries where products are becoming more differentiated.

Hunnicutt and Israelsen (2003) examine the brand advertising effects from individual producers which are voluntarily funding under differentiated product industry. Considering the monopolistically competitive industry, they develop a conceptual model for generic and brand advertising, which includes the market share and degree of product differentiation. Advertising benefits are clearly examined by showing the market expansion effects and branding effects through comparative statistic analyses. Chakravarti & Janiszewski (2004) examine effects of the generic advertising on the brand preferences through experiments under various scenarios. Results of the experiments suggest that the generic advertising may affect consumers' choice of brand through increasing or decreasing their perceived brand differentiation. They also found that contrary to the objective of generic advertising, the generic advertising may increase the brand differentiation. Bass et al. (2005) analyze effects of generic and brand advertising in a duopoly market using an optimal control model. In this study, each firm can make decision its price, and generic and brand advertising levels. The study shows that a stronger firm is more likely to invest in generic advertising, and the market share mainly depends on the brand advertising. Crespi (2007) and Isariyawongse et al. (2007) extend the Crespi and Marette (2002)'s framework to vertical differentiation and horizontal product differentiation in duopoly market, respectively.

Although these previous studies provide useful framework for understanding the relationship between generic and brand advertising programs, the relationship has not been clearly identified. Most analytical results from these studies were not able to sign

the marginal effects of optimal brand advertising and its effectiveness with respect to generic advertising. In addition, the empirical analysis has been rarely conducted.

Model

A Cournot competition model with generic advertising and brand advertising is developed in this study. Similar to Quirmbach (1988) and Hamilton (1999), the model considers generic advertising and brand advertising parameters as demand shifters. Unlike the previous studies (e.g. Crespi and Marrett 2002; Crespi 2007; Isariyawongse, Kudo, and Tremblay 2007), the model developed in this study considers demand shifts and rotations with elasticities of demand and advertising, market concentration, degree of product differentiation, and product relationship (i.e., substitutes, complements, and independent). Applying elasticities and alternative patterns of demand shift to the model is expected to provide clearer results of generic advertising impact on brand advertising than previous studies.

Consider a Cournot oligopoly market where exists a fixed number, n, of producing firms, and entry is not concerned. We assume some firms, k ($k < n$), in this market produce a branded and nonbranded product and may attempt to create subjective product differentiation through brand advertising. The products are substantially undifferentiated, but the brand products are advertised. Other firms, n-k, produce only nonbranded products (Tremblay and Polasky 2002: Zhang, Sexton, and Alston 2002). The firms producing nonbranded products face the same market demands, and compete in quantity in the homogeneous market. The firms producing brand products that share the

brand product's market engage in competition to expand its market share. We assume the total brand advertising may increase market demand.

The output of a representative firm i is denoted by q_i and the market output, Q, is represented as: $Q = \sum_i q_i$. A marketing board of commodity controls the level of generic advertising expenditures funded by checkoff assessment. The mandatory checkoffs are levied to participants in the programs by a unit assessment rate, t. When the marketing board allocates the entire checkoff fee to the spending of generic advertising, the feasible generic advertising expenditures, G, is represented as: $G=tQ$. In the market exist brands, B_N, less than or equal to the number of firms (products), i.e., $B_N \leq n$. Some producers invest their brand advertising for consumers to convince the qualities and attributes of the goods for subjective differentiation. The brand advertising expenditure for firm i is denoted as B_i , which is a function of the expenditures of generic advertising, i.e., B_i (t). In previous studies, the effectiveness of generic advertising was estimated by measuring the expansion of total market demand, and therefore in this case the market demand curve would shift up rightward. In this study, however, we consider clockwise and counterclockwise rotations of market demand curve as well as shift-up. The main concerns are the effectiveness of generic advertising on brand advertising effectiveness; when generic advertising affects the total demand to change in shifting upward or rotating (counter) clockwise, what is direction of changing the brand advertising effectiveness in? Is it same or opposite direction, or none with the direction of the effectiveness of generic advertising?

The market demand is given by the inverse demand function $P=P(Q, t, B(t))$. We

assume that the inverse demand is twice continuously differentiable, and let the subscripts indicate partial differentiation, $P_Q<0$ for all Q. That is, the slope of the market demand is downward regardless of the effects of demand shifters. The demand curve is concave in generic advertising assessment rates and brand advertising expenditures, that is, $P_t>0$, $P_B>0$, and $P_{tt}<0$, $P_{BB}<0$.

Based on these assumptions, we consider three scenarios. The scenarios start with advertising which leads parallel shifts demand, then considers elastic and inelastic rotation of the demand curve. The three scenarios related to shift and rotation of demand curves include:

i) $P_{Qt} = 0$ indicating parallel shift.

ii) $P_{Qt}< 0$, $P_{QB} < 0$ indicating inelastic rotation (clockwise rotation).

iii) $P_{Qt}>0$, $P_{QB} >0$ indicating elastic rotation (counterclockwise rotation).

$P_{Qt} \equiv \partial P_Q/\partial t$ denotes the change in the slope of demand curve (P_Q) with respect to the generic advertising assessment rate (t). The first scenario, therefore, $P_t > 0$ and $P_{Qt} = 0$ is a parallel increase in demand, which is a demand shift typically applied in the advertising literatures. However, a case may occur when the brand advertising does not affect demand shift, but changes the slope of it. The second scenario, in addition to the concave conditions, P_{Qt} or $P_{QB} < 0$, means that both generic and brand advertising decrease the variation of consumers' valuation and make the demand curve steeper, consequently the more advertising, the more elastic demand. The third scenario is the opposite case of the second one. When generic and brand advertising lead consumers to be more sensitive to price change and increase the variation of consumers' valuations, demand curve becomes

more flat and elastic.

The firm *i*'s cost function is given by $C_i = C(q_i, B_i(t))$. We assume that while the marginal cost of production (c_{q_i}) is constant for any output level q_i, the marginal cost of brand advertising is increasing ($c_{B_i} > 0$) at a decreasing rate ($c_{B_iB_i} < 0$). Each firm has an equivalent marginal cost of production and brand advertising expenditures.

Then, the firm *i*'s profit function may be written as:

$$\pi_i = [P(Q,t,B_i(t)) - t]q_i - C_i(q_i, B_i(t)) .$$

Differentiating π_i with respect to q_i yields the first-order condition as:

(1) $$\pi_{q_i} = P(Q,t,B_i(t)) - t + q_i P_Q - c_{q_i} = 0 .$$

Then, the second order condition of firm *i* would be:

(2) $$\pi_{q_iq_i} = 2P_Q(Q,t,B_i(t)) + q_i P_{QQ} - c_{q_iq_i} < 0 .$$

Rewritting equation (1) using firm *i*'s market share leads to:

(3) $$\pi_{q_i} = P(Q,t,B_i(t)) - t + s_i Q P_Q - c_{q_i} = 0 ,$$

where $s_i = q_i / Q$ represents market share of firm *i*.

Following Dixit (1986) , Seade (1980), and Vives (1999), conditions for existence and stability of oligopoly equilibrium are:

(4) $$1 - c_{q_iq_i} / P_Q > 0 ,$$

(5) $$P_Q + q_i P_{QQ} < 0 , \text{ and}$$

(6) $$\lambda = \pi_{q_iq_i} + (1 - s_i)\pi_{q_iq_{-i}} < 0 ,$$

where the second term of the right hand side of equation (6) is the summation of the

output response of all other firms except firm *i*. Equation (6) is a necessary condition for a maximum, and requires (Hamilton 1999b; Seade 1980).

To address the optimal brand advertising expenditure at the firm level, its expenditure B_i^* is treated as a continuous variable following Seade (1980), Besley(1989), and Hamilton (1999) . After the checkoff fee is set to maximize the industrial total profit by the marketing board, a representative firm's optimal brand advertising, $B^*_i(t)$, is derived from the following indirect profit function:

$$\pi_i^* = \left[P(Q^*, t^*, B_i(t^*)) - t^*\right] q_i^* - C_i(q_i^*, B_i(t^*)) \geq 0 \quad (7)$$

where the superscript (*) denotes optimal levels of checkoff assessment rates and output levels at firm and market.

To find the effects of generic advertising on firm-level output and the optimal brand advertising expenditure, total differentiation is conducted on FOC of equations (3) And (7). Combining these equations yields:

$$\begin{bmatrix} \lambda & \pi_{qB_i} \\ \pi^*_{q_{-i}} & \pi^*_{B_i} \end{bmatrix} \begin{bmatrix} dq_i \\ dB_i \end{bmatrix} = -\begin{bmatrix} P_T - 1 + s_i Q P_{QT} \\ (P_T - 1) q_i - c_{B_i t} \end{bmatrix} dt, \quad (8)$$

where $P_T = P_t + P_{B_i t}$ and $P_{QT} = P_{Qt} + P_{QB_i t}$. Suppose the coefficient matrix in equation (8) is denoted as Φ. Then the determinant of the matrix Φ is:

$$Det(\Phi) = (2P_Q + s_i Q P_{QQ})(q_i P_{B_i} - c_{B_i}) - (1 - s_i)(P_Q + s_i Q P_{QQ}) c_{B_i}. \quad (9)$$

Rewriting equation (9) with elasticity terms gives:

$$Det(\Phi) = P_Q\left[(2 - s_i E)(q_i P_B - c_B) - (1 - s_i)(1 - s_i E) c_B\right], \quad (9)'$$

where $E \equiv -Q P_{QQ} / P_Q$ denotes the elasticity of the slope of the inverse demand. A direction of E implies curvature of the demand curve: E>0, E<0, and E=0 implies convex, concave, and linear, respectively (Zheng, Bar, and Kaiser 2010). Implying the two stability conditions, two terms in the bracket, $(2 - s_i E)$ and $(1 - s_i E)$, are positive. The first term, $(2 - s_i E)$, measures firm i's response to rival's output (Hamilton 1999b; Zheng, Bar, and Kaiser 2010). Collecting terms and rewriting equation (9)' yields:

$$Det(\Phi) = P_Q \left\{ (2 - s_i E) q_i P_{B_i} - c_{B_i} \left[(2 - s_i E) + (1 - s_i)(1 - s_i E) \right] \right\}.$$

The first part of the brace in braces measures the slope of firm i's marginal revenue changed by its own brand advertising (denoted by $MR^i_{QR_B}$), and the second part of the brace denotes the summation of the slope changes of the marginal revenue due to increasing marginal costs of brand advertising in the entire market (denoted by $MR^M_{QC_B}$). Then, the determinant can be rewritten as:

$$Det(\Phi) = P_Q \left(MR^i_{QR_B} - MR^M_{QC_B} \right) = P_Q \Omega,$$

where $\Omega = MR^i_{QR_B} - MR^M_{QC_B}$. Three cases exist in determining the sign of the determinant, which shows the relative impacts of slope changes of marginal revenue to individual firm and entire market:

i) $\Omega < 0$, ii) $\Omega > 0$, and iii) $\Omega = 0$.

We assume that $MR^i_{QR_B} < MR^M_{QC_B}$, therefore, Ω<0, and then $Det(\Phi) > 0$.

We consider first the effect of generic advertising on the individual firm's output. Since the unit checkoff assessment rate has a similar nature to the production checkoff,

the firm-level output is expected to decrease with the assessment rate. The impact of generic advertising on the individual firm's output, therefore, is generally expected to be negative: $\frac{dq_i}{dt} < 0$. From equation (8), the impact of change of generic advertising (represented by the checkoff assessment rate) on the output of a representative firm is derived:

(10) $$\frac{dq_i}{dt} = \frac{c_B\left(P_t + s_i QP_{Qt} - 1\right) - q_i s_i QP_{QB}}{\left(2P_Q + s_i QP_{QQ}\right)\left(q_i P_B - c_B\right) - \left(1 - s_i\right)\left(P_Q + s_i QP_{QQ}\right)c_B},$$

and is rewritten with elasticity terms as:

(10)' $$\frac{dq_i}{dt} = \frac{P_t c_B\left(1 + s_i \Psi_t - P_t^{-1}\right) - P_B q_i s_i \Psi_B}{P_Q\left[\left(2 - s_i E\right)\left(q_i P_B - c_B\right) - \left(1 - s_i\right)\left(1 - s_i E\right)c_B\right]},$$

where $\Psi_t = Q\frac{P_{Qt}}{P_t}$, $\Psi_B = Q\frac{P_{QB}}{P_B}$, which represent the output elasticities of generic advertising assessment rates and brand advertising expenditures, respectively (Hamilton 1999; Cowan 2004).

To determine sign of (10)', we should consider the three cases of demand changes influenced by generic advertising, which are shift up, elastic, or inelastic rotation of the demand curve. Each of the cases is also dependent on the influences of brand advertising effects, which are no change slope, elastic, or inelastic rotation of the demand curve. Table 1 shows the results of signs of dq_i/dt for each case of demand changes. Generally, when generic advertising attempts to expand total market demand (P_{Qt} = 0 shift up) and leads to elastic demand (P_{Qt} > 0 rotates counterclockwise), most of the signs denote positive except that the case of brand advertising leads to elastic demand.

According to the results, when brand advertising makes the demand inelastic or does not change the slope of the demand curve, most of the cases are positive or conditionally positive except the case when generic advertising makes the demand inelastic, that is, rotates the demand curve clockwise.

In the opposite case, when brand advertising leads elastic demand, most of the cases are negative or ambiguous. While generic advertising leads to increase market demand ($P_{Qt} = 0$) and rotate clockwise ($P_{Qt} < 0$, inelastic demand), if brand advertising makes demand elastic, then the signs show negative or ambiguous. In the case of generic advertising generating the market demand curve to rotate clockwise (inelastic demand), most of the effectiveness show negative or ambiguous except when Pt>1 and brand advertising make elastic demand or do not change the slope of the demand curve, the impacts of generic advertising on firm-level output are conditionally positive.

Opponents of generic advertising argue that it may lessen consumers' subjective perceptions about the brand's differentiated attributes that have been increased by brand advertising (Glickman 1997). If a firm spends more money for brand advertising to recover a brand's reputation that was impacted by generic advertising, the sign of (11)' would be positive, $\frac{dB_i^*}{dt} > 0$.

The impact of generic advertising (represented by the checkoff assessment rate) on the optimal brand advertising expenditures of a representative firm is derived:

$$(11) \qquad \frac{dB_i^*}{dt} = \frac{c_{Bt}(1-s_i)(P_Q + s_i QP_{QQ}) - (2P_Q + s_i QP_{QQ})((P_T - 1)q_i - c_{Bt})}{(2P_Q + s_i QP_{QQ})(q_i P_B - c_B) - (1-s_i)(P_Q + s_i QP_{QQ})c_B},$$

and rewriting with the elasticity terms yields:

(11)' $$\frac{dB_i^*}{dt} = \frac{c_{Bt}\left[(1-s_i)(1-s_iE)+(2-s_iE)\right]-(2-s_iE)(P_T-1)q_i}{(2-s_iE)(q_iP_B-c_B)-(1-s_i)(1-s_iE)c_B}.$$

The sign of equation (11)' is determined by the direction of the numerator. At first, we determine directions of the second part of the numerator. Since the sign of the first term, (2-s_iE) is already known as positive, the unkown sign of the second part is the second term, (P_T -1). Therefore, the sign depends on whether P_T =1, P_T >1, or P_T <0. Since P_T is the summation of Pt and P_{Bt}, the results are dependent on the sign of P_{Bt}. We assume P_T and P_t ,which has scenarios with the values of it, are always positive , and then we can determine the sign of P_{Bt} with respect to the scenarios of P_t . Table 2 shows the signs of all terms for each scenario. Depending on the sign of c_{Bt} , the second differentiation of marginal cost of brand advertising with respect to the generic advertising, the sign of all cases are reported in table 3.

When the total effect of generic advertising on the inverse demand (market price) is greater than or equal to one, P_T ≥1, and the effect of generic advertising on the marginal brand advertising cost is negative or equal to zero, c_{Bt} ≤0, the signs of these cases are positive except that there may be no impact when P_T =1 and c_{Bt} =0. This result means that the firm would spend more brand advertising expenditures as generic advertising increases. Since the effect of generic advertising on the marginal brand advertising cost is less than zero in these cases, the marginal brand advertising expenditures increase with diminishing rate with respect to the checkoff fee. In other cases when the generic advertising assessment rate causes an increase, the marginal cost of brand advertising with increasing rate or at least no impact on it, c_{Bt} ≥0, and when the

total effectiveness of generic advertising on market price is less than or equal to one ($P_T \leq 1$), the signs of these cases are negative. In this case, generic advertising may lead to decrease of brand advertising expenditures.

Summary of Analytical Results

An analytical model developed in this study examines impacts of generic advertising on brand advertising. To explain the relationship, we applied the theory of demand changes; shift-up, clockwise, and counterclockwise rotation. Through comparative statistics using elasticities of demand and advertising, we were able to sign three equations: the effect of generic advertising on an individual's product $\frac{dq_i}{dt}$ and the impact of generic advertising on brand advertising expenditures $\frac{dB_i}{dt}$.

When generic advertising expands the total market demand (shift-up) and makes demand inelastic (clockwise rotation) and brand advertising also induces inelastic demand, generic advertising positively affects an individual firm's output and the marginal profit effectiveness of brand advertising. When generic advertising influences brand advertising to make less elastic demand, the individual firm can reduce brand advertising expenditures. Chakravarti and Janiszewski (2004) provide useful experiment results to support our findings. According to their experiment, generic advertising shows a differentiating (nondifferentiating) attribute decreases access to information about the nondifferentiating (differentiating) attribute, which results in an increase in the importance of the differentiating (nondifferentiating) attribute and decreased price

response. In that case, generic advertising potentially redistributes market shares among brands. This implies that in case that generic advertising gives some messages about subjective differentiating attributes which are for examples taste, colors, figures, rather than objective information, generic advertising may help to change consumer's preferences to branded product. Connecting to the analytical results of this study, when generic advertising may induce market demand inelastic (rotate clockwise), it would help to brand advertising.

Zhang and Sexton (2002), however, suggest that if advertising makes retail demand less elastic, generic advertising will exacerbate the oligopoly distortion in the market and will lead to an outcome harmful to producers that causes reduced farm sales.

Directions for Further Research

The analytical framework developed so far should be extended to product differentiation and concentration. The empirical verification of the relationship between generic and brand advertising should also be conducted. A complete version of this study will be presented at the conference.

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Table 1. Impact of Generic Advertising on Firm-level Output, dq_i/dt

	$P_{QB}=0$	$P_{QB}>0$	$P_{QB}<0$
Case 1: Generic advertising does not change the slope of demand curve, $P_{Qt}=0$			
$P_t=1$	0	-	+
$P_t>1$	+	?	+
$P_t<1$	-	-	?
Case 2: Generic advertising rotates counterclockwise the demand curve (elastic demands), $P_{Qt}>0$			
$P_t=1$	+	?	+
$P_t>1$	+	?	+
$P_t<1$	$+ \text{ if } s_i\Psi_t > \lvert P_t-1\rvert$	$- \text{ if } s_i\Psi_t \le \lvert P_t-1\rvert$	$+ \text{ if } s_i\Psi_t \ge \lvert P_t-1\rvert$
Case 3: Generic advertising rotates clockwise the demand curve (inelastic demands), $P_{Qt}<0$			
$P_t=1$	-	-	?
$P_t>1$	$+ \text{ if } s_i\Psi_t > \lvert P_t-1\rvert$	$- \text{ if } s_i\Psi_t \ge \lvert P_t-1\rvert$	$+ \text{ if } s_i\Psi_t \le \lvert P_t-1\rvert$
$P_t<1$	-	-	?

Table 2. Impact of Generic Advertising on the Optimal Brand Advertising Expenditures (Scenarios)

	$P_T = 1$	$P_T > 1$	$P_T < 1$
$P_t = 1$	$P_{Bt}=0$	$P_{Bt}>0$	$P_{Bt}<0$
$P_t > 1$	$P_{Bt}<0$	$P_{Bt}\geq 0$	$P_{Bt}<0$
$P_t < 1$	$P_{Bt}>0$	$P_{Bt}>0$	$P_{Bt}\leq 0$

Table 3. Impact of Generic Advertising on the Optimal Brand Advertising Expenditures; dB_i/dt

	$P_T = 1$	$P_T > 1$	$P_T < 1$
$c_{Bt} = 0$	0	+	-
$c_{Bt} > 0$	-	?	-
$c_{Bt} < 0$	+	+	?